Docket No.: DAT-0002
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Ziya Aral, et al.

Application No.: 09/910,662   Confirmation No.: 2628

Filed: July 20, 2001   Art Unit: 2151

For: METHOD AND APPARATUS FOR   Examiner: Nghi V. Tran
     ASYNCHRONOUS MIRRORING USING
     TCP/IP INTERNET PROTOCOL

REPLY BRIEF

MS Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is a Reply Brief under 37 C.F.R. § 41.41 in response to the Examiner's Answer mailed on March 5, 2008.

All arguments presented within the Appeal Brief resubmitted on July 18, 2007 are incorporated herein by reference. For ease of reading, portions of the arguments from the Appeal Brief are essentially reproduced below along with additional arguments that are responsive to the Examiner's Answer.

STATUS OF CLAIMS:

Claims 1-11 and 18-26 are pending in this application, and are the subject of this Appeal. All of the pending claims have been rejected.

As noted in the Appeal Brief: Claims 1, 5, 9, 11, 18 and 20 stand or fall together. Claims 2 and 6 stand or fall together. Claims 3, 4, 10 and 19 stand or fall together. Claim 7 stands or falls alone. Claim 8 stands or falls alone. Claims 21, 22, 25 and 26 stand or fall together. Claims 23 and 24 stand or fall together.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL:

The grounds of rejection presented for consideration in this appeal are as follows and are confirmed in the Examiner's answer. It is also noted that separate arguments regarding each set of claims standing or falling together have been provided in the Appeal Brief, and herein.

Whether the Examiner erred in rejecting claims 1-6, 9-11, 18-21, 23 and 25 under 35 U.S.C. § 102(e) as being anticipated over U.S. Pat. No. 6,823,336 to Srinivasan et al. ("Srinivasan").

Whether the Examiner erred in rejecting claim 7 under 35 U.S.C. § 103(a) as being unpatentable over Srinivasan in view of U.S. Pat. No. 5,673,382 to Cannon et al. ("Cannon").

Whether the Examiner erred in rejecting claim 8 under 35 U.S.C. § 103(a) as being unpatentable over Srinivasan in view of Cannon as applied to claim 7, and further in view of U.S. Pat. No. 5,713,014 to Durflinger.

ARGUMENT:

In the Final Office Action of August 23, 2006, the Examiner erred in rejecting claims 1-6, 9-11, 18-21, 23 and 25 under 35 U.S.C. § 102(e) as being anticipated by U.S. Pat. No. 6,823,336 to Srinivasan et al. ("Srinivasan"); erred in rejecting claim 7 under 35 U.S.C. § 103(a)

2

as being unpatentable over Srinivasan in view of U.S. Pat. No. 5,673,382 to Cannon et al. ("Cannon"); and erred in rejecting claim 8 under 35 U.S.C. § 103(a) as being unpatentable over Srinivasan in view of Cannon as applied to claim 7, and further in view of U.S. Pat. No. 5,713,014 to Durflinger.

<u>The Examiner erred in rejecting claims 1, 5, 9, 11, 18 and 20 under 35 U.S.C. §</u> <u>102(e) as being anticipated by Srinivasan</u>:

Independent claim 1 recites: recites: *[a] system for mirroring write operations from a local storage system onto a remote storage system, the system comprising:*

an asynchronous mirroring driver resident in the local storage system for intercepting I/O transactions to a storage disk of the local storage system, identifying a series of write transactions issued to said storage disk, making an exact copy of the series of write transactions, and storing said exact copy within a series of files that are created on a file-system of the local storage system; and

a first asynchronous mirroring coordinator resident on the local storage system for invoking a file transfer system to transmit the series of files on the local file-system of the local storage system to a file system of the remote storage system via a non-proprietary network protocol to accommodate an exact reproduction at the remote storage system of the series of write transactions as issued to said storage disk of the local storage system.

Appellant's claimed invention provides asynchronous mirrored storage by intercepting I/O transactions to a storage disk of a local storage system, and retaining an exact copy of the corresponding write transactions within a series of regular file system files. The asynchronous mirroring coordinator may then transmit these files on any desired schedule to the file system of the remote storage system using a non-proprietary network protocol to accommodate an exact reproduction of the write transactions as issued to the storage disk of the local storage system.

These claimed features provide several advantages and distinctions over conventional systems. Retaining an exact record of write transactions allows a return to any point on a per-transaction basis in the event of failure on either the local or remote storage side. The overhead

3

of managing a local buffer and corresponding with the remote system in response to regular write transactions is also avoided. Finally, implementation of file system files and non-proprietary network communication protocols (*e.g.*, IP and/or FTP) introduces flexibility and resiliency to the system.

Srinivasan clearly fails to disclose (or suggest) various claimed features. Specifically, in independent claim 1: (1) the I/O transactions to a storage disk are intercepted and an exact copy of the write transactions is retained; (2) the retained exact copy of the write transactions is stored within a series of files created on the file system of the local storage system; and (3) the series of files is transmitted to the remote storage system using a non-propriety network protocol to accommodate an exact reproduction of the series of write transactions at the remote storage system. These claimed features are absent from Srinivasan.

A fundamental flaw in the position of the Examiner, re-emphasized in the Examiner's Answer, is the characterization of the "dataset" of Srinivisan as an example of *"storing said exact copy [of the series of write transactions] within a series of files that are created on a file-system of the local storage system."* However, this is both incorrect, and also is logically inconsistent with also concluding that there is any disclosure of *"invoking a file transfer system to transmit the series of files on the local file-system of the local storage system to a file system of the remote storage system,"* as the dataset is never transmitted to the remote storage system (as a series of files or otherwise) in Srinivisan.

Srinivasan discloses techniques for ensuring dataset consistency. That is, the "dataset" is provided on the local disk(s) and is mirrored at the secondary or remote location. To accomplish this mirroring, Srinivasan does not retain exact copies of write transactions and store them in a series of file system files that are then transmitted to the secondary system. Instead, Srinivasan directly sends write transactions to the secondary system, which (on the secondary side) implements "A" and "B" buffers and corresponding read and write algorithms to service reads and writes that are requested by applications on the primary system. In servicing these reads and writes, changes are immediately made to the dataset on the primary system, and the same entire "dataset" is mirrored on the secondary system, using the buffers and a read/write algorithm. FIG. 2 of Srinivasan quite clearly illustrates these features. The write transactions are sent over a dedicated line 22, and the corresponding "A" and "B" dataset revisions (43, 44)

are stored and maintained <u>on the secondary side</u>. There is absolutely no retaining of writes on the primary side, storing an exact copy of the write transactions in a series of file system files, and then transmitting those file system files to the remote storage system, as claimed by Appellant.

A careful review of the Examiner's position reveals that it either misconstrues or takes out of context what is stated in Srinivasan to allege that the reference discloses the features of Appellant's claimed invention. For example, the Examiner cites column 5, lines 17-36 as disclosing the interception of I/O transactions. However, this passage and the corresponding figure merely appear to exemplify that write transactions are concurrently sent to the remote location over a dedicated line. Accordingly, this cited passage merely reinforces the distinction noted above - that is, the write transactions are directly sent to the secondary system right over the transmission line. There is no mention in Srinivasan of storing an exact copy of a series of write transactions in a series of file system files on the primary (local) side.

Nor do other relied-upon passages support a conclusion that Srinivasan in any way discloses storing an exact copy of the write transactions in a series of file system files. For example, the Examiner apparently takes the position that Srinivasan makes an exact copy of the write transactions merely because Srinivasan maintains a copy of the dataset. In Srinivasan, the dataset is the data itself (*e.g.*, database, file(s), etc.) that appears in storage at the primary location, and (as a mirrored version) at the secondary location. When revisions to the dataset are made on the primary side, the Srinivasan system ensures that the same revisions are applied to the mirrored version of the dataset found on the secondary side. This is completely different from and thus does not disclose Appellant's claimed retention of the exact copy of write transactions in a series of file system files, and then transmitting that series of file system files as claimed.

It is important to understand that the dataset is not the write transactions themselves, nor therefore an exact copy of the write transactions. The dataset is merely a representation of what is on the disk after the write transactions have been executed. The write transactions themselves are separate, even if they are used to effect what the dataset becomes. Srinivasan thus does not disclose storing the exact copy of the write transactions in file system files as is claimed.

In the Examiner's Answer, the Examiner notes that the dataset could be "a set of volumes, a single volume, a file system, a set of files, or a single file". (See, *e.g.*, Srinivasan at 5:60-63). This is true, but it misses the point. The dataset of Srinivasan is merely what is found on the local disk, and necessarily reproduced on the secondary disk pursuant to a disk mirroring operation. A disk can, of course, store a set of files. However, this is not what is claimed by Appellant. In Appellant's claimed invention the write transactions themselves are exactly copied into a series of file system files, with the series of files itself being transmitted to the remote side. This is clearly distinct from mirroring a local disk that happens to have files on it in a disk mirroring operation.

It is also noted that the Examiner's position is logically inconsistent. The dataset is what is stored on the local disk (and mirrored on the secondary disk). This dataset represents the end-result of all of the changes in what is stored on disk. It is not an example of a copy of the write transactions themselves and thus, even if the dataset consists of "files", providing such a dataset is clearly not an example of *"making an exact copy of the series of write transactions, and storing said exact copy within a series of files that are created on a file-system of the local storage system."*

Furthermore, although the Examiner has not articulated a position as such, it is noted that the alternative embodiment of Srinivasan involving "delta volumes" as depicted in FIGs. 8 and 9 also fails to disclose or suggest the above-described features of Appellant's claimed invention. That is, this embodiment also fails to disclose storing an exact copy of write transactions issued to a storage disk on the local side in a series of file system files, or transmitting that series of files to the remote storage system to accommodate an exact reproduction of the series of write transactions as issued to the storage disk of the local storage system. This embodiment involves dual redundant lines 125, 126 that send updates to the primary and secondary systems. The "delta volumes" that are retained on both the primary and secondary systems do not represent storing exact copies of write transactions to the storage disk in file system files. Instead, these are representative of a consolidation or "delta set" of changes that are made to file system blocks and that comprise a set of changes to the file system blocks that, when viewed as a whole, leave the file system intact. Thus these delta volumes are neither an example of retaining an exact copy of write transactions to the disk, nor are they an example

6

of retaining such an exact copy in a series of file system files that are stored and ultimately sent to the remote storage system.

Finally, there are other claimed features that are absent from Srinivasan. For example, Srinivasan merely mentions "transmission line 22" and does not specify a non-propriety network protocol for transmitting the files. Rather, it appears that the transmission line disclosed in Srinivasan is a conventional dedicated line for providing mirrored storage. There is no mention of a network protocol, let alone a non-proprietary one for accommodating the transmission.

For reasons similar to those provided regarding claim 1, Srinivasan does not disclose or suggest the features recited in independent claim 5. Dependent claims 9, 11, 18 and 20 are also neither disclosed nor suggested by Srinivasan, since they incorporate the features respectively recited in these independent claims, as well as for their separately recited features.

The Examiner erred in rejecting claims 2 and 6 under 35 U.S.C. § 102(e) as being anticipated by Srinivasan:

Dependent claim 2 recites: *[t]he system claim 1 further comprising:*

a second asynchronous mirroring coordinator resident on the remote storage system for detecting the series of files on the file system of the remote storage system, opening the files and reading the exact copy of the series of write transactions in these files; and

an asynchronous mirroring driver resident on the remote storage system for receiving the exact copy of the series of write transactions from the second asynchronous mirroring coordinator and issuing the transactions to a remote device connected to the remote storage system which is configured to mirror the local storage device on the local storage system.

These additional features are also absent from Srinivasan. In Srinivasan, there is no detection of the series of files on the file system of the remote system, or opening such files and reading the exact copy of the series of write transaction, all features clearly recited in this claim. At best, updates may be received or write transactions may be iteratively executed on both the

primary and secondary systems. There is no provision of such write transactions in files that are transmitted to the secondary system.

In the Examiner's Answer, the Examiner refers to FIG. 8 and column 14, line 46 through column 15, line 14 of Srinivasan as allegedly disclosing certain claimed features. However, this citation merely reiterates that Srinivasan fails to disclose or suggest the independent claims as well as claims 2 and 6. Specifically, the cited passage refers to the usage of "delta volumes" in Srinivasan as introduced above. As noted, delta volumes are in no way a disclosure of storing an exact copy of write transactions issued to a storage disk on the local side in a series of file system files, or transmitting that series of files to the remote storage system to accommodate an exact reproduction of the series of write transactions as issued to the storage disk of the local storage system. Instead, Srinivasan uses dual redundant lines 125, 126 that send updates to the primary and secondary systems. The "delta volumes" that are retained on both the primary and secondary systems do not represent storing exact copies of write transactions to the storage disk in file system files. Instead, these are representative of a consolidation or the "delta set" of changes that are made to file system blocks and that comprise numerous changes to the file system blocks that, when viewed as a whole, leave the file system intact. Thus these delta volumes are neither an example of retaining an exact copy of write transactions to the disk, nor are they an example of retaining such an exact copy in a series of file system files that are stored and ultimately sent to the remote storage system. As is clear on the record, Appellant's claimed invention is not to a write-consolidation scheme such as provided by a delta volume technique.

Additionally, as indicated in column 14, lines 46-63, Srinivasan merely forwards the transaction commit to the secondary storage, which also manifests that Srinivasan sends the write transactions to the secondary storage rather than compiling them in a series of file system files. While Srinivasan does concurrently use the delta volume technique for coherence, Srinivasan does not retain the exact copy of the write transactions in a series of file system files that are sent and then received and issued in the claimed fashion.

For reasons similar to those provided regarding claim 2, claim 6 is similarly neither disclosed nor suggested by Srinivasan.

The Examiner erred in rejecting claims 3, 4, 10 and 19 under 35 U.S.C. § 102(e) as being anticipated by Srinivasan:

Claim 3 recites: *[a] method for mirroring write operations from a local storage system to a remote storage system, the method comprising the steps of:*

intercepting I/O transactions to a storage disk of the local storage system;

identifying a series of write transactions to said storage disk from the intercepted I/O transactions;

storing an exact copy of the series of write transactions within a series of files that are created on a file-system of the local storage system;

transmitting the series of files from the local storage system to the remote storage system through an Internet connection to accommodate a reproduction at the remote storage system of the series of write transactions as issued to said storage disk of the local storage system.

These claimed features are absent from Srinivasan. For reasons clearly stated above, Srinivasan does not disclose or suggest "storing an exact copy of the series of write transactions within a series of files that are created on a file-system of the local storage system," or "transmitting the series of files from the local storage system to the remote storage system ... to accommodate a reproduction at the remote storage system of the series of write transactions as issued ...."

With regard to independent claim 3, Srinivasan is also lacking in that it fails to disclose or suggest making such transmission of the series of files through an Internet connection. At best, Srinivasan generally discloses a connection. There is no mention of an Internet connection. Indeed, it would be completely counter-intuitive to conclude even the desirability of an Internet connection in the scheme disclosed by Srinivasan, where the primary and secondary systems are both accessed responsive to write commands through switching operations and access to either dataset revisions "A" or "B" (*e.g.*, as shown in FIG. 3 of Srinivasan). A conclusion that these features disclose sending file system files with exact

copies of a series of write transactions through an Internet connection is in no way supported by the reference.

Claims 4, 10 and 19 depend from claim 3 and thus incorporate the features recited therein. These dependent claims are thus distinct from Srinivasan for the reasons set forth above, as well as for the features separately recited in these claims.

<u>The Examiner erred in rejecting claims 21, 22, 25 and 26 under 35 U.S.C. § 102(e) as being anticipated by Srinivasan:</u>

Claim 21 recites: *[t]he system of claim 1, wherein the series of write transactions is one of a plurality of series of I/O transactions that are respectively retained in corresponding ones of the series of files, and individual ones of the series of files include pointers to accommodate sequencing the series of files, whereby a transaction level record of changes to the storage disk of the local storage system is provided for the remote storage system.*

These claimed features are also absent from Srinivasan. As noted previously, the passages of Srinivasan cited in the Examiner's Answer merely further support the conclusion that Srinivasan clearly does not disclose or suggest what is found in the independent claims, let alone the additional dependent claim features. That is, the Examiner's Answer refers to FIG. 10 and column 13, lines 40-65 of Srinivasan as purportedly disclosing the claimed "pointers to accommodate sequencing" and retention of the transaction level record of changes. The figure and cited passage, however, do not describe file system files that contain series of write transactions, or more particularly the transaction level record of changes. Instead, this passage describes the sending of "delta set" information. Delta set information refers consolidated changes to the data. That allows the same consolidated changes to the remote (secondary) side so that the data remains consistent as a whole. There is no retained exact record of write transactions to the storage disk of the local storage system, within a series of file system files, or of having pointers to sequence those file system files.

Claims 22, 25 and 26 are also neither disclosed nor suggested by Srinivasan for the reasons stated regarding claim 21.

The Examiner erred in rejecting claims 23 and 24 under 35 U.S.C. § 102(e) as being anticipated by Srinivasan:

Claim 23 recites: *[t]he method of claim 3, wherein the series of write transactions is one of a plurality of series of I/O transactions that are respectively retained in corresponding ones of the series of files, and individual ones of the series of files include pointers to accommodate sequencing the series of files, whereby a transaction level record of changes to the storage disk of the local storage system is provided for the remote storage system.* These claimed features are neither disclosed nor suggested for the reasons stated regarding independent claim 3 above, as well as the reasons stated regarding claim 21 above.

For the foregoing reasons, Appellant respectfully requests reversal of the Examiner's rejection of claims 1-6, 9-11, 18-21, 23 and 25 under 35 U.S.C. § 102(e) as being anticipated by Srinivasan.

The Examiner erred in rejecting claim 7 under 35 U.S.C. § 103(a) as being unpatentable over Srinivasan in view of Cannon:

Claim 7 recites: *[t]he system of claim 1, wherein individual ones of the series of files comprise:*

a Header portion that includes information on the total size of the file;

an I/O Control Block portion which indicates address offsets where each transaction in the file is to be stored on the remotely located destination storage system, and which further indicates the size of the data for each transaction; and

a Data portion which contains the data for each transaction in the file.

These claimed features are not disclosed or suggested by Cannon. First, Cannon makes no mention whatsoever of the features described above in connection with independent claim 1. Cannon discloses a reference list that is used to locate files within a storage volume. (Cannon, 8:28-46). The reference list is part of a database and is used to organize the location of files. Providing an external reference list is clearly distinct from providing a header portion, I/O control block, and Data portion within each of the series of files as claimed by Applicant.

11

Moreover, Cannon does not disclose the particular information claimed by Appellant, namely (1) *address offsets where each transaction in the file is to be stored on the remotely located destination storage system*, (2) *the size of the data for each transaction*, and (3) *the data for each transaction in the file*. Instead, the reference list of Cannon is said to identify the storage pool, storage volume, offset within the storage volume and size of the file that is referenced in the list. This is clearly distinct from providing the noted information within the files themselves, and also clearly offers no description of address offsets for each transaction in the file, or of the size of and data for each transaction in the file, as claimed by Appellant.

Thus as noted above Srinivasan fails to disclose the series of files even in a general sense, and Cannon merely discloses a database reference listing that is generally off-mark and obviously omits the claimed particulars. Appellant thus submits that a *prima facie* case of obviousness has not been presented, since even in combination Srinivasan and Cannon would still fail to yield the claimed invention.

Moreover, there is no apparent reason to conclude that Srinivasan and Cannon should be combined in the noted fashion. For one, Srinivasan does not even disclose the basic information in the series of files as claimed, as noted above. Furthermore, there would be no reason to look to Cannon regarding a database reference file. Even if one concedes that "common sense" could support a combination of references, such is lacking in the proposed offering.

Appellant respectfully requests reversal of the Examiner's rejection of claim 7 under 35 U.S.C. § 103(a) as being unpatentable over Srinivasan in view of Cannon.

The Examiner erred in rejecting claim 8 under 35 U.S.C. § 103(a) as being unpatentable over Srinivasan in view of Cannon as applied to claim 7, and further in view of Durflinger:

Claim 8 recites: *[t]he system of claim 7, wherein the Header portion further includes:*

a pointer to the I/O Control Block portion which indicates the offset where the I/O Control Block portion of the file begins; and

a pointer to the Data portion, which indicates the offset where the Data portion of the file begins.

Durflinger discloses a database management system that uses pointers to locate data positions within files. Usage of pointers for database management is clearly in a different context, and markedly different from Appellant's claimed invention. For that reason, there is no disclosure or suggestion in Durflinger of the particular pointers that are claimed by Appellant. There is no disclosure of a header that points to an I/O Control Block portion within the same file, or a pointer, which points to a Data portion within the same file.

It should also be noted that none of the references, including Cannon, disclose the claimed features within the files themselves. Cannon discloses a reference list for a database that provides the location of files, and Durflinger discloses external pointers for database management. To the extent that Cannon clearly has flaws as noted regarding claim 7, they remain uncured by Durflinger.

Since the combination of Srinivasan, Cannon and Durflinger would still fail to yield the features of Appellant's claimed invention, Appellant submits that a *prima facie* case of obviousness has not been presented regarding claim 8.

Appellant respectfully requests reversal of the Examiner's rejection of claim 8 under 35 U.S.C. § 103(a) as being unpatentable over Srinivasan in view of Cannon and Durflinger.

Appellant believes no additional fee is due with this Brief. However, if a fee is due, please charge our Deposit Account No. 18-0013, under Order No. DAT-0002 from which the undersigned is authorized to draw.

Dated: May 1, 2008

Respectfully submitted,

By_____
Christopher M. Tobin
   Registration No.: 40,290
RADER, FISHMAN & GRAUER PLLC
Correspondence Customer Number: 23353
Attorney for Appellant

13